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THE FLORA OF AUSTRALIA

1. TYPICAL CHARACTER OF THE AUSTRALIAN FLORA

Effect of Climate and Altitude

As would naturally be expected in a territory whose limits extend from the high tropical latitudes of North Queensland to the lower temperate regions of Victoria and Tasmania, and whose physical elevation varies from the sea coast (or levels even below that of the sea) to peaks whose tops are covered during a great part of the year with snow, the vegetation of Australia is largely varied. In the Queensland tropics there are many forms which belong to the Malayan and Oceanic regions. In the north of Western Australia. The tropical area, comprising some 364,000 square miles, is lacking in these forms. The assertion of land contiguity between Northern Queensland and New Guinea and the Malayan Archipelago generally, frequently made by geologists and zoologists, is thus supported by botanical evidence. The existence of many types characteristic of Australia and South Africa points to the possibility of a land connection between those continents by way of what is now the Indian Ocean. But, whatever evidences of land connection may be discovered, the fact remains that the great bulk of the vegetation of the temperate zone, where the flora is profuse and various, is distinctively Australian. Hence Australia has been isolated for a long time, but probably not so long as New Zealand.

Soils and Geological Formations

While climate is generally the principal factor deciding the main features of a district's sylvan landscape, the soil and sub-soil exercise important influence in determining the facies of the verdure-clad earth. A notable example of this is seen in the differences between the vegetation of Perth and that of the Darling Range. With general climatic conditions fairly constant, a similar rainfall and an equivalent altitude, it is notable that in the one case the soil consists almost entirely of sand or sandy swamps, while in the other the soil on and near the hills is derived from igneous rocks, and is richer and more retentive of moisture.

Special Plant Adaptations

Remarkable modifications have been effected in the vegetation that exists in many of the deserts of the interior, enabling the flora to withstand the inhospitable conditions of a hot, arid climate.

The general dryness of the climate of Australia has led to marked adaptations in form and structure. Spiny plants, With foliage of hard, woody ribs and reduced surface area, are characteristic. Exhalation with the air of the moisture absorbed from the soil by the roots, is thus reduced through the absence of soft cellular parts. The moisture absorbed by the root-system, scant because of the desert soil, is eagerly taken up by the arid atmosphere. In these, the relative amount of transpiring foliage is small, and appears to correspond to the soil conditions. Short, scale-like leaves, for example, mark considerable reduction in the foliage area. In the great majority of acacias, the true leaves are suppressed, the leaf stalks, however, remaining in a flat leaf-like form (**phyllodia**), or the leaf may be entirely suppressed, the leaf-functions being carried on by the stems of the plants. In some desert plants, as **Verbenacæ** and **Solanacea**, a dense coat of hairs covers the leaves or whole plant; in others, as in some acacias, the surface of leaves and twigs is substantially a layer of resin, both modifications greatly reducing the transpiration, and serving also as a protection against the extremes of heat and cold to which they are subjected. Generally the vegetation on the west coast is more drought-resisting (**xerophilous**) than that on the east coast.

The Australian an Ancient Vegetation

Of particular interest from a scientific point of view, is the fact that the Australian flora is of a primitive type. Forms belonging to early stages in plant evolution exist upon this continent, which otherwise can only be studied as fossils in rocks of long-past geological ages. This is seen particularly in **Byblis**, **Casuarina**, **Cephalotus**, **Nuytsia**, **Polyjypompholyx**, and **Phylloglossum**.

General Features of the Australian Landscape

The coastal regions furnish the most luxuriant vegetation. A marked physical feature of the continent is the chain of mountain ranges which runs along part of the southern and the eastern coast, roughly parallel to the contour, and at little distance from the shore. Upon these heights, and on the uplands and foot-hills which stretch from them to the coast, is to be found the heaviest forest. There is, however, in Western Australia, also a great forest belt, some 350 miles in length, and from 50 to 100 miles in breadth, not on the coastal side but extending eastward from the Darling Ranges. Inland, from what may be called the coastal forest region, the vegetation becomes thinner as the more arid regions replace those of heavier rainfall, and rapidly dwindles, till bushes, scrubs, and dwarf eucalypts, with belts of pine at intervals, give place to a scant and inferior vegetation. Except in its south-west portion, Western Australia has little forest. South Australia has still less. But the great Australian mountain system runs from the Grampians of Western Victoria easterly, following generally the trend of the coast-line, north-easterly into New South Wales, and northerly through that State and Queensland to Cape York, with a spur which turns westward and forms the watershed between the streams which flow north into the Gulf of Carpentaria and those which eventually reach the Murray. Here there are large trees and dense undergrowth, very often giving place to rich pasture lands on the extensive plateaux and great plains that stretch away into the interior. Under the copious rainfall of the coastal regions the wild flowers that belong to Australia. variegated, bright, often scentless, grow luxuriously.

Forestry, Agriculture, and Horticulture

Both hardwoods and softwoods abound in the forests, their commercial uses being set out in the chapter on Forestry. Among the exotics that have been acclimatised are many that yield valuable timber. Cereals are grown in large quantities, but none are indigenous. Native plants fit for human consumption are insignificant. Generally the indigenous plants that can be utilised for food need some preparation before being used. The part suitable for food is the yam-like root of some, the stems, foliage, or seeds of others. Useful fruits are found, but most of them require to be cooked,

being very acid in their native state. In tropical Queensland there are pleasant fruits of the lime family. Edible species of fungi are also common, but none are marketed or much used, except the common mushroom. The aborigines eat the fruits of the doobah (**Marsdenia** **Leichhardtiana**), the seeds of acacias, the grains of some indigenous grasses and of the nardoo (**Marsilia quadrifolia**), as well as other vegetable products having a more or less meagre store of nutriment. Many of the native grasses and other herbage have high nutritive properties, affording rich fodder, but there is not a native fodder clover; on the contrary, many native Leguminosæ are poisonous. The cultivation of native wildflowers, and the sporting of selected stocks, has led to the introduction of many new varieties, and horticulture is a growing industry.

2. BOTANIC DISTRIBUTION

Tropical and Extra-tropical Regions

The vegetation of Australia may be roughly classed as tropical and extra-tropical. The line of geographical distribution between the two classes is not distinctly marked, but it may be said that the former class covers the north-eastern uplands, where the Malayan and Oceanic forms have, by their incursion enriched the east coast from Torres Strait as far south as Illawarra, and also the tropical regions of Western Australia, where the different climatic conditions and the absence of high mountains and the permanent streams and still waters usually associated with them do not cause the vegetation of these tropical latitudes to be specially distinguished. Extra-tropical plants, mostly hardwoods, characterise the Australian forests of temperate regions.

(a) The North-east Tropical Vegetation. While something under a tenth of Queensland bears timber of commercial value, at least a third of that State may be said to be covered with trees which have a local use for building and other purposes. The vegetation is rich, the number and variety of plants being very large. There are a large number of fibrous plants of the orders Malvaceæ, Sterculiaceæ, Leguminosæ, Urticaceæ, Scitamineæ, Amaryllideæ, and Aroideæ. Of indigenous fruits the principal are the lime and Davidson's plum, with others of the order Euphorbiaceæ, Ampelideæ, Rutaceæ, and Urticaceæ. There are numerous fungi—many of them edible. Among trees, acacias, araucarias, xanthorrhoeas, **eucalypts**, canariums and callitris are the most abundant. Besides these there are medicinal, oil, perfumery, rubber, and spice plants, as well as some which give tanning and dyeing material. Trees of many varieties, of unique beauty in the landscape, and yielding handsome timber for carpentry, cover the forests. Overlapping of the tropical and extra-tropical vegetation is inevitable, and the merging of the former into the latter, becomes more and more marked after the New South Wales border is crossed. The vegetation of the north-east may be summarised by saying that between the Dividing Range and the Pacific, there are some of the finest belts of forest in the continent. Among eucalypts are several varieties of ironbark (*Eucalyptus paniculata*, *E. crebra*, *E. siderophloia*, *E. sideroxylon*) tallow-wood (*E. microcorys*), blackbutt (*E. pilularis*), grey gum (*E. propinqua*), spotted gum (*E. maculata*), turpentine (*Syncarpia laurifolia*), forest red gum (*E. tereticornis*), and red mahogany (*E. resinifera*); among conifers, the Moreton Bay (*Araucaria Gunninghami*), brown (*Podocarpus elata*), and Bunya-Bunya (*Araucaria Bidwillii*) pines; while among the brush timbers of fine grain are red cedar (*Cedrela australis*), rosewood (*Dysoxylon Muelleri*), red bean (*Dysoxylon Muelleri*), black bean (*Castanospermum australe*), white beech (*Gmelina Leichhardtii*), silky oak (*Grevillea robusta* and *Orites excelsa*), and tulipwood (*Harpulia pendula*). In Queensland, a large portion of the country west of the Divide is an extensive plateau running into great plains, but with little timber. Towards the centre of the continent, where the land gradually falls to a vast shallow basin, with low hilly ridges at intervals on its rim, and wide expanses of plain country with short water courses losing themselves in the desert, the tree growth is very scanty, consisting chiefly of stunted eucalypts, such as the gimlet-gum (*E. salubris*), and black box (*E. microtheca*), the desert sheoak, acacias and mallee. Westward of the ranges in New South Wales, where the table-land sinks down to undulating country and vast plains, through which the tributaries of the Murray make their way, the vegetation changes to

scrub and open forest, consisting of eucalypts such as red gum (*E. rostrata*) along the water-courses, with several varieties of box, cypress and other pines, and wattles. Farther inland again the timber becomes more sparse, being chiefly cypress pine, stunted eucalypts, and casuarinas, with extensive areas of mallee scrub.

(b) The North-west Tropical Vegetation. In the northern district of Western Australia, there are extensive tracts of pasture lands on the slopes drained by the rivers flowing into the Indian Ocean. Inland from these, are stunted bush and scrub lands, which in some cases impinge even upon the sea border. The Kimberley district has forest country about the Fitzroy River, and the King Leopold Ranges are tree-clad. Farther eastward, and continuing across the border into the Northern Territory, grasses and stunted growths form the main vegetation. The flatness of the country accounts for the absence of mountain flora, the vertical elevation rarely reaching 1500 feet. The chief geological features are sandstone of the carboniferous era forming the tableland, and basaltic plains. As a consequence, the flora is very little varied, the largest order of plants being Leguminosæ, represented by acacias and cassias. The smaller plants include Indigofera, Crotalaria, Daviesia, and Bossia. Next to Leguminosæ, Gramineæ, of which there are several new types, are the most numerous. With the exception of the grasses, all the monocotyledons are limited. The Myrtaceæ include eucalypts (principally *E. rostrata*) and melaleucas. The Loranthaceæ, Rubiaceæ, Cucurbitaceæ and Proteaceæ are represented by several plants. Cornpositæ, Chenopodiaceæ, Santalaceæ and Orchideæ, are rare, but members of the family Lythraceæ are more numerous than might have been expected. The Gymnosperms are sparingly represented. Euphorbiaceæ are surprisingly scarce. Perhaps the most marked characteristic of the whole tract is the almost entire absence of lichens and mosses though ferns are plentiful in the vicinity of the Victoria River.

(c) The Australian Extra-tropical Vegetation. Australia is believed to have been free from geological upheavals and cataclysms for a longer period than most other lands. The persistence of type that has resulted has enabled its flora to become very well adapted to prevailing climatic conditions. The chief feature of the Australian forest landscape, as presented by the eastern, south-eastern, and south-western portions of the continent, is the presence of giant hardwoods, mostly eucalypts—very often rapidly reproductive, and attaining to a great age. The existing types are of high antiquity, and are possessed of special means of resistance to the extremes of temperature, to excessive sunshine, and to alternations of drought and flood to which they are subject. Along the shores of the Great Australian Bight, and in the north and north-west, there are no extensive forests. In the desert interior the vegetation is generally dwarfed and stunted, the forests of the inland slopes of the eastern mountains gradually thinning from the thickly-clad hilltops to second-class eucalypts, whilst these latter in turn give place to extensive areas of mallee scrub, the vegetation becoming more scarce, until in the arid interior, patches are found with no covering of herbage of any kind. The hill slopes, however, are often clad with rich grass, and along the water-courses eucalypts such as red gum persist, with pines and acacias. In the south-west, where the ranges approach closely to the ocean, the forest belt extends beyond the watershed some distance inland. The great belt of jarrah (*E. marginata*) which stretches eastward from the Darling Hills, has two distinct but narrow belts of tuart (*E. gomphocephala*) and red gum (*E. calophylla*) between it and the coast. Within this extensive tract of jarrah, in the extreme south-western part of the State, is the main karri (*E. diversicolor*) belt, stretching from Cape Hamelin to Torbay. In this region the jarrah, karri, tuart and red gum are the dominant trees. In the somewhat drier districts stretching eastward of the jarrah belt, there is a fairly wide strip of white gum (*E. redunca*) enclosing a narrow belt of York gum (*E. loxophleba*) which, as regards its northern and southern limits, is almost coterminous with the jarrah. Eastward of this again the arid region is entered, and the forest rapidly dwindles, changing first to a poorer growth of white gum until, in the sandy wastes of the goldfields region, the vegetation is scant and stunted, consisting chiefly of the eucalypts, locally known as morrell, (*E. macrocarpa*) and gimlet (*E. salubris*) gums, with some belts of pines at intervals. The Tasmanian flora represents that of South-east Australia, but there are also some valuable conifers, chiefly in the western and southern parts, such as the Huon (*Dacrydium Franklini*), King William, and celery-top

(*Phyllocladus rhomboidalis*) pines. The forest area of the island is extensive, covering two-thirds of its surface. The principal eucalypts are blue-gum (*E. globulus*), stringy-bark (*E. obliqua*), peppermint (*E. amygdalina*,—the mountain ash of Victoria), and silver-top ironbark (*E. Sieberiana*); the chief fine-grain woods are blackwood (*Acacia melanoxylon*), beech or myrtle (*Fagus Cunninghamii*), sassafras (*Atherosperma moschata*), native cherry (*Exocarpus cupressiformis*) native box (*Bursaria spinosa*), and casuarina or sheoak. These are distributed throughout the State.

The extra-tropical vegetation of Australia is highly differentiated from that of the rest of the world. In the eastern States, however, there is some admixture in the flora of species derived in the course of past ages from almost all other regions of the globe, but South and Western Australia are as regards their flora, typically and purely Australian. The natural orders which are endemic, or nearly so, to Australia are either entirely confined to the continent or are represented elsewhere only by one or a few outlying species, mostly in adjoining regions. They are the Tremandreae, Stackhousiaceae, Stylideae, Goodeniaceae, Casuarineae, Phyllodendreae.

Like Australia, New Zealand has its own characteristic flora: 72 per cent, of its species are endemic, 21 per cent, are found also in Australia, and 7 per cent, are sub-antarctic. The forests are often mixed in their growths, with pines of various kinds generally predominating, the finest tree being the kauri pine (*Agathis australis*). Tawa (*Beilschmiedia tawa*) and totara (*Podocarpus totara*) also flourish. In the Middle Island several species of beech (*Nothofagus*) are found, particularly on the higher levels. In the forest areas there is dense undergrowth. In the meadows the tussock form is characteristic of various grasses and sedges. The shrub-form and the iris-like form also help to make up the facies. The scrub is made up to a large extent of manuka, which seems to be the same as our *Leptospermum scoparium*. *Bursaria spinosa* is common here as in the rest of Australia, this shrub being universal throughout Australia and New Zealand. *Pittosporum* is native to New Zealand.

(d) Alpine Vegetation. The Australian continent is not remarkably irregular in physical elevation, the highest elevation being only 7000 feet above sea level, while a great deal of the land surface stretches for many miles in extensive plains, offering no kind of relief to the eye. In these circumstances little characteristic alpine flora is to be expected. There is none in Western Australia, the vegetation on heights and plains having the same physiognomy. In Eastern and South-eastern Australia and New Zealand only the highest points of the mountains bear alpine flora. The transition from the forest to the alpine region is gradual, considerable overlapping of alpine and low land flora being noticeable, and differentiation of alpine types is less marked than usual. Numerous bushes grow on these transition areas. Endemic conifers are wanting in the Australian Alps; but on many mountains which attain a height of 5000 feet, the flowering plants display rich and varied colours.

Exotics

While Australia has made large and flourishing additions to the forest flora of many countries, a large number of exotics have been successfully introduced here, furnishing a welcome variation to the sombre landscape presented by the prevailing eucalypts. With practically no cereals of value as food for man and with few fodder plants, and these generally of an inferior kind, the fruits of the earth which Australia offered were indeed small. Now, however, her fields are sown with introduced grains and grasses, and yield abundantly. But alien weeds have come in too. Native pests are few in number, but some of the most aggressive weeds have intruded themselves, to the detriment of the native flora.

Persistence of Types

Though there is every probability that individual varieties have been eliminated in the various terrestrial convulsions that have altered the land surface of this part of the globe, there is good reason for believing that Nature, "so careful of the type," has not suffered the eradication of representative forms. Nor has the hand of man, careless, in the strenuous days of early colonisation, in conserving the original vegetation, stamped out any of the indigenous species. That many places have been set aside for the preservation, as virgin country, of areas where the plant covering is yet undisturbed, attests a desire to render to botanic science that assistance which only forms belonging to an early stage of vegetation, such as the Australian, can afford.

3. NATURAL ORDERS OF PLANTS REPRESENTED IN AUSTRALIA

The following is a list of the natural orders of plants represented in Australia

CLASS 1.- DICOTYLEDONS.

SUB-CLASS 1. - POLYPETALAE.

1. Ranunculaceæ	18. Elatineæ	35. Stackhousiæ	52. Samydacæ
2. Dilleniaceæ	19. Hypericineæ	36. Rhamneæ	53. Passifloreæ
3. Magnoliaceæ	20. Guttiferæ	37. Ampelideæ	54. Cucurbitaceæ
4. Anonaceæ	21. Malvaceæ	38. Sapindacetæ	55. Ficoideæ
5. Menispermaceæ	22. Sterculiaceæ	39. Anacardiaceæ	56. Umbelliferæ
6. Nymphæaceæ	23. Tiliaceæ	40. Leguminosæ	57. Araliaceæ
SUB-ORDERS			
(i) Papilionaceæ			
(ii) Cæsalpineæ			
(iii) Mimosæ			
7. Papaveraceæ	24. Lineæ	41. Rosaceæ	58. Cornaceæ
8. Cruciferæ	25. Malpighiaceæ	42. Saxifrageæ	59. Loranthaceæ
9. Capparideæ	26. Zygophyllaceæ	43. Crassulaceæ	60. Caprifoliaceæ
10. Violariæ	27. Geraniaceæ	44. Droseraceæ	61. Rubiaceæ
11. Bixineæ	28. Rutaceæ	45. Halorageæ	62. Compositæ
12. Pittosporeæ	29. Simarubæ	46. Rhizophoreæ	
13. Tremandreæ	30. Burseraceæ	47. Combretaceæ	
14. Polygaletæ	31. Meliaceæ	48. Myrtaceæ	
15. Frankeniaceæ	32. Olacinetæ	49. Melastomaceæ	
16. Caryophyleæ	33. Illicineæ	50. Lythariæ	
17. Portulacæ	34. Celastrineæ	51. Onagariæ	

SUB-CLASS II. - MONOPETALAE.

63. Stylideæ	77. Loganiaceæ	91. Selaginetæ	105. Thymeleæ
64. Goodenovieæ	78. Gentianetæ	92. Verbenaceæ	106.
			Elæagnaceæ
65. Campanulaceæ	79. Hydrophyllaceæ	93. Labiataæ	107.
			Nepenthaceæ
66. Ericaceæ	80. Boragineæ	94. Plantagineæ	108.
			Euphorbiaceæ
67. Epacrideæ	81. Convolvulaceæ	95. Phytolaccaceæ	109. Urticeæ
68. Plumbagineæ	82. Solaneæ	96. Chenopodiaceæ	110. Casuarineæ
69. Primulacæ	83. Scrophularineæ	97. Amarantaceæ	111. Piperaceæ
70. Myrsineæ	84. Lentibularieæ	98. Paronychiaceæ	112.
			Aristolochiaceæ
71. Sapotaceæ	85. Orobanchacæ	99. Polygonaceæ	113. Cupuliferæ
72. Ebenaceæ	86. Gesneraceæ	100. Nyctagineæ	114. Santalaceæ
73. Styracacæ	87. Bignoniaceæ	101. Myristiceæ	115.
			Balanophoreæ
74. Jasmineæ	88. Acanthaceæ	102. Monimiaceæ	116. Coniferæ
75. Apocyneæ	89. Pedalineæ	103. Laurineæ	117. Cycadeæ
76. Asclepiadeæ	90. Myoporineæ	104. Proteaceæ	

CLASS II. - MONOCOTYLEDONS.

118. Hydrocharideæ	125. Dioscorideæ	132. Juncaceæ	139. Alismaceæ
119. Scitamineæ	126. Roxburghiaceæ	133. Palmæ	140. Eriocaulæ
120. Orchideæ	127. Liliaceæ	134. Pandanaceæ	141. Centrolepideæ
121. Burmanniaceæ	128. Pontederaceæ	135. Aroideæ	142. Restiaceæ
122. Irideæ	129. Philydraceæ	136. Typhaceæ	143. Cyperaceæ
123. Amaryllideæ	130. Xyrideæ	137. Lemnaceæ	144. Gramineæ
124. Taccaceæ	131. Commellinaceæ	138. Naiadeæ	

CLASS III. - ACOTYLEDONS (Non-flowering Vegetation).

145. Lycopodiaceæ	146. Marsileaceæ	147. Filices
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